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Towards a Systematic, Cost-Effective Approach for ERP Selection

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Abstract—Existing experiences indicate that one of the most prominent reasons that some ERP implementations fail is related to selecting an improper ERP package. Among those important factors resulting in inappropriate ERP selections, one is to ignore preliminary activities that should be done before the evaluation of ERP packages. Another factor yielding these unsuitable selections is that usually organizations employ prolonged and costly selection processes in such extent that sometimes the process would never be finalized or sometimes the evaluation team might perform many key final activities in an incomplete or inaccurate way due to exhaustion, lack of interest or out-of-date data. In this paper, a systematic approach that recommends some activities to be done before and after the main selection phase is introduced for choosing an ERP package. On the other hand, the proposed approach has utilized some ideas that accelerates the selection process at the same time that reduces the probability of an erroneous final selection.

Keywords—enterprise resource planning, evaluation and selection of ERP packages, organizational readiness for employing ERP, evaluation lists.

I. Introduction

SINCE an organization that wants to purchase an ERP (*Enterprise Resource Planning*) software should adapt its processes as much as possible to the *best practices* or *standards* of the purchased software [5], choosing an ERP system compatible with organization's business goals and strategies is deeply concerned [6]. The importance of the ERP selection increases when it is realized that there is no unique and comprehensive ERP solution with maximized adaptation capability in organizations [4]. In other words, current ERP packages are not able to provide a universal model for all business strategies, tactics and processes. Thus, existence of a precise, formal and yet fast selection process, provides a way to improve organization's benefits when employing an ERP solution [2].

Inspecting existing experiences in ERP selections in Iranian companies [1] shows prerequisites that must be taken into account before choosing an ERP are usually disregarded. Without such prerequisites, doing the selection process based on a systematic method (e.g., according to a specific budget plan, scheduling and risk analysis model) becomes difficult or even impossible. Besides, without doing activities in order to estimate organization's readiness for ERP implementation, the evaluation team is not aware of the gap between current situation with the favorite state that the organization must be equipped to be ready for an ERP implementation. In this way, the evaluation team is not able to consider the degree of differences as a characteristic in the selection process.

On the other hand, current experiences assert that employed procedures in Iranian companies for the evaluation and selection of ERP packages are often prolonged and expensive [1]. Thus, at some final steps in the selection process, evaluation team's data is not consistent with existing facts and as a result an inappropriate selection is offered; also, sometimes participant's initial motivations diminishes during the selection process and thus some essential selection phases are done incompletely or inaccurately; Even occasionally, this leads to halting the selection process without any particular result.

In this paper, in order to solve the above mentioned problems, a systematic process for selecting an appropriate ERP package is offered, in which:

1) it is emphasized to perform pre-activities in a specific phase, named *pre-selection*
2) some activities are performed after the selection phase in a particular phase, named *post-selection*
3) by applying some modifications to conventional selection processes, that some examples of them are mentioned in [1], selection is accelerated.
4) in addition to accelerate selection process, by suggesting some tips, the probability of incorrect selection would be decreased.

The overall scheme of the proposed approach is illustrated in figure 1. As it is clear from the figure, in the suggested approach, the overall selection process is divided into three sub-processes: pre-selection, selection and post-selection. These sub-processes are discussed in the following sections of the paper. Firstly, section 2 discusses about the details of the pre-selection sub-process and the steps within. In section 3, we introduce those activities that embody the selection process and are performed to evaluate ERP packages existing in the market and choose the most suitable alternative based on specific criteria. In section 4, we point to those activities referred by the title of post-selection sub-process and performed to complete the evaluation and selection process. The last section is devoted to the conclusion and directions for future work.

Just before ending this section, it is important to mention that as illustrated in figure 1, the overall selection process is started when prior to that in a phase titled *strategic plan development*, all the reasons of utilizing an ERP solution in

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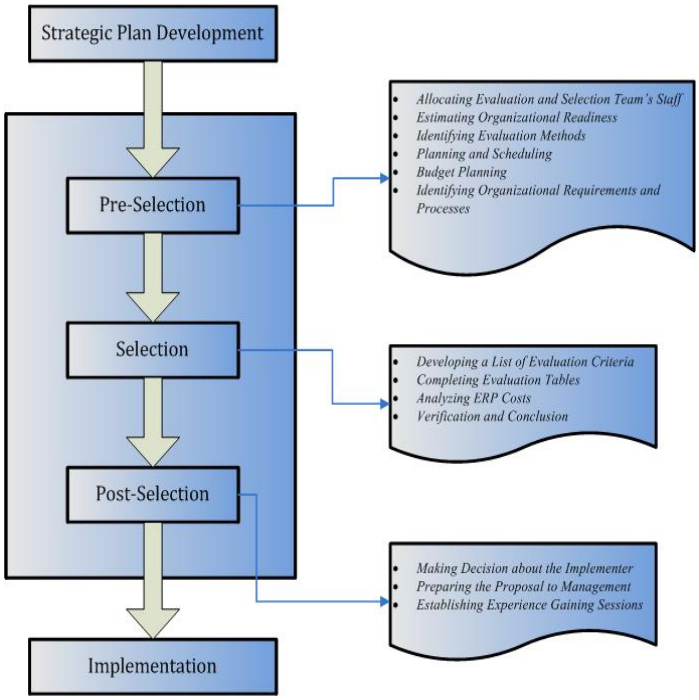


Fig. 1. Overall scheme of the proposed selection approach

the organization has been identified. In other words, prior to beginning the ERP selection process, it is necessary to obtain logical reasons and motivations in its employment from the organization's strategic plan; specially, organization's superior managers should be convinced why a substantial expenditure must be allocated for a software that its benefits are clearly available long time after implementation and usage, and also its implementation encounters considerable risks. On the other hand, it is assumed that after completing the selection phase and purchasing the selected ERP package, the implementation phase is started that its own details and considerations are beyond the scope of this paper.

II. Pre-Selection Sub-Process

In the initial steps of selecting an ERP package some essential questions similar to the following must be answered:

1) Which people or groups do the selection process?
2) What is the amount of budget dedicated to perform the evaluation and selection process?
3) What is the estimated scheduling for the evaluation and selection process?
4) Which organization's requirements are going to be resolved in assisting an ERP solution?
5) What are the essential organization's business processes that must be preserved after employing an ERP solution?
6) More importantly, to what extent the organization is ready to implement and utilize an ERP package.

In this regard, the pre-selection sub-process consists of activities such as allocating evaluation and selection team's staff, estimating organization's readiness for the implementation and establishment of ERP, identifying evaluation methods, planning and scheduling the selection sub-process, developing the selection budget plan and finally specifying organization's requirements and processes.

A. The First Phase - Allocating Selection Team's Staff

Since the ERP selection is not only a decision in the IT scope, but also a business level decision and the purchased ERP would affect many (or all) of organization's functional departments (e.g., financial, human resource, production and manufacturing), it is essential that representatives from all functional departments to be in the evaluation and selection team and the selection process must be done based on the consensus of all these people. This is also important from a different point of view: it would guarantee the participation and interest of employees in each functional department during the ERP implementation. According to major organizational structure, the selection team is suggested to include the following subgroups:

1) Functional group: this group constitutes the main part of the selection team. Its members are superior organization's employees that have comprehensive knowledge about organization's business operations, product manufacturing technology, and the competition level of the organization. The members of this group actually are representatives among all employees working at organization's different departments that preferably have involved in organization's function improvement activities such as TQM (Total Quality Management) and BPR (Business Process Reengineering).
2) Technology group: this group's members must have the following characteristics:
   - Having a good knowledge of the application software development and implementation, specially conventional software development environments and practical methods in software life-cycle
   - Being aware of hardware, communicating networks, and general software systems.
   - Familiar with topics such as scalability, adaptability, upgrading methods, traffic in local and wide area networks, load estimation on systems and finally system's anticipated response time.
3) Commercial group: this group's members must be expert in areas such as business contracts, definition and specification of deliverables, acceptance conditions and approval routines, performance guarantee, legal obligations, licensing procedures, upgrades and released versions and finally legal deductions.

After organizing sub-groups, it is recommended that one of the organization's superior managers to be assigned as the group's responsible and to be present in all selection phases in order to resolve, in necessary situations, disagreements among people in different groups or even in the same group. Another essential responsibility of this person is to cooperate seriously for assigning weights to each organization's requirement or concern. The topics of requirements and assigned-weights will be both more discussed in the remainder of the paper.

It should be considered that sometimes it is suggested that the selection team makes use of external consultants

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to progress the selection process. However, we believe that due to external consultant's preferences or predispositions to special software packages, this suggestion is not appropriate; of course, we propose to use external companies in order to provide consultation for directing the overall selection process or to provide knowledge required for evaluation; however, the final decision should be done by the internal evaluation group itself.

B. The Second Phase - Estimating Organizational Readiness

In this phase, a formal assessment of organization's weaknesses and strengths or in other words organization's readiness level for the ERP implementation is accomplished. Based on this assessment, the organization perceives whether it is well prepared for implementing and utilizing an ERP package. By this assessment in place, the organization can also choose an ERP package that the gap between the desired situation, as a prerequisite for its implementation, with the current organization's state can be eliminated during the ERP selection and implementation.

Unfortunately, this assessment usually is not fulfilled in ERP consumer organizations [1]. Failure to perform this kind of assessment is one of the major reasons for ERP implementation failure, accomplishment postponement, increased costs than initial estimation and ultimately failure to provide parts of expected functionalities. In organization's readiness assessment phase, preparedness should be specified in the following areas (except process and commercial readiness, others are obtained from [3]):

1) Technical readiness: This relates to the sufficiency and efficiency of networks, servers, software and hardware platforms, and ultimately the quantity and skill level of IT department's employees.
2) Functional readiness: This consists of the number of employees and their skills and experiences in organization's key functional departments.
3) Process readiness: About this item it must be specified that how much organization's business processes are documented.
4) Communication readiness: Having an effective connection with all the organization's stakeholders (inside or outside the organization) is essential for an effective ERP implementation. Clear and continuous communications will aid the organization to be ready for revolutionizing the business, which is inevitable in an ERP implementation. For instance, the key milestones of the ERP implementation project should be specified and announced to all shareholders as they precisely be aware of these changes and thus obtain the required preparation.
5) Cultural readiness: In order to estimate the cultural readiness, the following key questions should be answered:
   - Do the organization's different groups have the experience to work together in a desirable manner?
   - Do the organization's internal committees direct the meetings effectively?
   - Do group decisions, that is based on consensus, are taken without incidence of serious and complicated conflict?
   - To what extent is the organization's general trend towards the ERP implementation? To what extent is the organization's acceptance level and capacity to comply with ERP standards?

   When estimating the cultural readiness, it is essential to notice that existing challenges in the organization will be possibly doubled due to a heavy project such as an ERP implementation. Therefore, the teamwork challenges should be considered and listed and then strategies should be developed to resolve their adverse effects on the implementation successfulness.
6) Administrative readiness: Related to this case, it is necessary to answer the following questions:
   - How the organization will manage a project with the scale of an ERP implementation? Has the organization ever accomplished a project with the size and complexity of an ERP implementation?
   - What project management skills are available in the organization? What project management processes and methods are usually used in the organization?
   - Are people involved in the ERP implementation project familiar with project management fundamentals such as planning, scheduling and control?
7) Resource readiness: About this item it must be determined that for each resource (e.g., human, financial and equipments) on which the organization is dependent during the ERP implementation, how much it is prepared?
8) Commercial readiness: This assessment will determine whether the organization is capable to handle contracts in the scale of purchasing and implementing large software packages such as ERP. It also shows which capabilities the commercial department of the organization have in negotiating with vendors, making contracts, defining deliverables, and finally determining and demanding performance guarantees, required legal commitments, upgrades and released versions.

C. The Third Phase - Identifying Evaluation Methods

In this step, the evaluation and selection team should determine which method or combination of methods will be used for evaluating ERP packages. In this field, there are known methods such as investigating comprehensive information of vendors and products, adaptive comparison of the packages in the market based on provided evaluation lists, observation of operational packages in sites, using technical and functional demo, sending request for proposal to various vendors, fit-gap analysis between organization and available packages and ultimately public demonstrations.

In this paper, with the aim of expediting the selection process, the following evaluation method is recommended: The main reason of protraction of conventional selection processes is performing a *comprehensive* evaluation (i.e., to consider all the organization's requirements and processes including necessary and unnecessary ones) on a *long* list of ERP packages.

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However, it is better, as a preliminary step, to perform the evaluation of ERP packages based on organization's essential requirements. In this way, time consuming assessments based on all organization's requirements and processes, could be done only on a short list including ERP packages resulted from the preliminary step.

In other words, there is no need to spend significant time and cost to review ERP applications that many of them are not appropriate based on the organization's scale and/or business type. Therefore, we recommend evaluating ERP packages in two *preliminary* and *final* assessment steps. Preliminary assessment step is done during a short period of time and based on available informational sources of various ERP vendors and packages. In this step, ERP packages are assessed based on the following two factors and packages that are recognized inappropriate would not be evaluated in the final assessment stage:

1) The ERP compliance with organization's business type, size (number of users or functional units), structure and distribution type
2) Proper and flexible response of the ERP package to those business processes of the organization that are essential and must be preserved after utilizing ERP in the organization.

After obtaining a short list of ERP packages from the preliminary evaluation, the following activities are conducted under the final assessment stage:

1) Sending request for proposals to the selected vendors and receiving their proposals (in [7] a systematic and comprehensive approach for preparing request for proposals has been introduced)
2) Requesting vendors to present their software systems
3) Asking each selected vendor to send a list of its customer profiles of their ERP Packages

Related to the second activity above, it should be mentioned that the presentation sessions are usually planned by vendors themselves. They employ professional presenters who know well which scenarios introduce their software in the best form. Even when the ERP package has serious errors or problems, the presenter knows to refer to which parts and to avoid referring to which parts during the presentation. To overcome this problem, we suggest to use planned presentation sessions.

Using planned presentation sessions, vendors can be provided with sequences of functions and data flows and asked to run the software based on those sequences during their presentation. Functions must be selected from organization's essential and unique business functionalities. Also, data flows must be allocated in sequences that simulate organization's daily activities. The more software reviewers are familiar with data flows, the more they can figure out software's strengths and weaknesses. On the other hand, if the software vendors are forced to use data flows proposed by the organization, less likely they would be able to hide their software problems.

Related to the third activity above, mentioned customers in submitted lists from vendors must:

- be rather native to the current organization (at least from the same country or area).
- have used the ERP package for at least one year, so as they have passed the learning step and have been familiar with weaknesses and strengths of the ERP software.
- have worked with the same educators and implementers as the new organization would cooperate with.
- be of similar size (especially from the employed people point of view) in comparison to the new organization.
- have the same business type (and a similar set of requirements and business processes) compared to the new organization.

After receiving such a list, the organization that has the highest number of mentioned features should be visited. According to the following reasons, we emphasize to visit organizations that are located at the same geographical area compared to the new organization:

- To ensure of appropriate quality of local support: This is particularly related to the fact that the vendor has not necessarily distributed its educators and implementers based on their skills and experiences evenly.
- Usually organizations located in the same geographical area (especially in a country) have similar concerns, requirements and processes.
- With emphasis on visiting an organization located on the similar geographical area in comparison to the new organization, the software vendor is not allowed to introduce its best customer. This is important for two reasons: First, it is waiting in vain to expect the result of an ERP implementation in the new organization to be as well as the implementation of the same package in the vendor's best customer site. Second, visiting the organization that is the vendor's best client and thus describes it in the best form, would teach nothing to the new organization.
- Implementation of an ERP package in the new organization would be closer to implementations done in local organizations. On the other hand, visiting local organizations, the new organization will find out in situations that the implementation do not go further, how the vendor responses and what reactions it would have.
- A more accurate vision could be achieved about real implementation costs.

D. Fourth to Sixth Phases

In the fourth step, those tasks related to main selection steps are determined, necessary resources are allocated to identified tasks and finally these tasks are scheduled. The importance of scheduling especially originates from the fact that the excessive prolongation of the evaluation and selection process may lead to serious problems. Without designing a clear and precise path for performing tasks, the ERP selection process may be very long and probably the organization would be faced with apathy of the selection team members and their deviation from the correct evaluation path.

In the fifth step, required budget necessary for the selection process is determined, according to the obtained plan in the previous step and concerning salary of people involved in the evaluation team, consultancies, travels, required software and hardware equipments, etc. Related to the sixth stage, it is

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necessary to mention that the selected ERP package must have at least the following features:

1) It should resolve organization's essential requirements.
2) It should support those essential processes of the organization which according to several considerations are required to be retained after the implementation of ERP.
3) It should implement processes which are going to be replaced with ERP best practices or standards in a flexible and simple manner, as much as possible.

Therefore, before beginning the selection sub-process, it is required that these two basic activities to be done: First, requirements of the organization, that are expected to be resolved by the ERP solution, should be listed and prioritized. Another one is to review and precisely document all business processes of the organization that are critical and will be affected by the ERP package. For the first task, comments from organization's functional users about ERP expected features should be gathered. To achieve this goal, it is necessary to reach a consensus on the demanded functionalities in each functional area (e.g., financial, business, and human resource).

About the second activity, it must be mentioned that the methods by which business processes are currently performed in the organization, are very likely to change after utilizing the ERP software. Therefore, before evaluating ERP packages, the purchaser organization should firstly (at least in an abstract level) realize how it does its business currently, in order that during evaluation, ERP packages with maximum adaptability acquire higher ranks.

III. Selection Sub-Process

After performing the activities listed under the title of pre-selection sub-process, the organization is prepared to start the main part of the selection process and meanwhile choose the most appropriate ERP to implement. In this section, the main steps of the selection process are reviewed.

A. The First Phase - Developing a List of Evaluation Criteria

As mentioned before, the purpose of the evaluation of ERP packages is to choose the most appropriate one according to the organization's business considerations. Naturally, the basis of such evaluation should be to apply predefined and previously accepted criteria. Using evaluation lists to achieve this goal is considered as a suitable approach. Generally, two groups of evaluation lists could be made: one group for software functional requirements and the other one for its non-functional requirements. It is worth noting that the functional requirements vary from one organization to another (notice that, these requirements have been determined, listed and prioritized at the final step of the pre-selection sub-process).

However, the non-functional requirements of organizations (specially, those organizations located at the same geographical area) are almost based on identical standards. For instance, in [1], according to these standards, a preliminary evaluation list have been provided for Iranian organizations in eight areas: ERP manufacturers (vendors), product, technical, installation and implementation, integration and communication, support and maintenance, inspection and control and finally documentation. The main content of these lists have been obtained from [3] and [8], but according to considerations and facilities of Iranian organizations, some items have been changed or some items have been added to or removed from them.

B. The Second Phase - Completing Evaluation Tables

When reporting on large integrated systems, such as ERP, capabilities are not easily comparable. In addition, participation of people from different work areas in the selection group leads to very different opinions in each capability of the system that is under assessment. Numerical measurement approach is one of the suitable solutions to the value assignment and disagreement elimination. Since assigned numbers are relative measures and in other words are not real values, they will cause discussions to be concentrated on specific numbers which are definable. In this approach, a weight or coefficient is assigned to each criterion in evaluation lists; these coefficients are revisable and could be changed until the majority of participants is satisfied with.

Criterion	Weight	Vendor1		Vendor2		Vendor3	
		degree	point	degree	point	degree	point

Fig. 2. The header of the comparative table for ERP packages

Figure 2 shows the header of the form that can be used to compare ERP systems: for instance, this form is suggested to compare ERP packages of three vendors. To use this form, the evaluation team should perform the following steps:

1) According to evaluation criteria, the first column of the form must be filled. These criteria should be placed in an order of priorities that all the evaluation team members agree on.
2) A set of coefficients or weights (For instance, numbers from one to ten), complying with clear and specific definitions, should be determined. Then, based on the importance of each criterion for the organization, a specific weight should be assigned to the criterion: larger weights should be assigned to more important criteria.
3) For each criterion, any of ERP systems under assessment, should be evaluated, using suggested methods in section 2.3, and thus assigned with numerical measures (or degrees). For instance, the following measures could be used: Excellent=4, Good=3, Average=2, Poor=1
4) For each criterion, the point of each ERP package is calculated by multiplying the weight of the criterion by the ERP package degree in this criterion. Then the sum of scores for each ERP package is obtained.

C. The Third Phase - Analyzing ERP Costs

After evaluating and ranking ERP packages, if the best ERP package costs a lot, evaluation and selection team members should decide on their final option after compromising between proposed software features (functional and non-functional) and its related costs. When analyzing different

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costs of an ERP package, numerous cases like acquiring the license of accessory software, third party software, operating system and general software such as Microsoft Office, utilizing professional consulting services, employing people from different departments, and finally purchasing hardware and network equipments should be considered.

D. The Fourth Phase - Verification and Conclusion

After going through steps up to this stage, probably an appropriate ERP package has been selected, but if there is still uncertainty between selection of three or less ERP packages or the organization prefers to be absolutely certain of the finally selected package, it is possible to ask the proposed vendor to introduce primary educators and implementers, that have been planned to take part in the ERP implementation, to the organization. The key point in this proposal is that unlike who present the software in demo sessions, educators and implementers should afterwards keep promises that they have made before. This is due to the fact that they should set up the ERP system and even import parts of real data into that and create real reports. Normally, these persons have better answers about what abilities the ERP system has and in what cases it is incapable.

Using primary educators and implementers, it is also possible to perform *scrip tests* and *load tests* prior to purchasing the selected ERP package. Script tests actually are scenarios to support the processes that must be provided by product vendors. Script tests are especially important for those processes that are essential for organization's business activities and are not configurable by standard functionalities of ERP systems. Success in these tests indicates flexibility of the ERP package. To see various suggested scenarios to support processes, refer to [1]. Load tests for ERP packages are similar to load tests for traditional systems. By these tests, one can estimate the load on the system in the real environment and then use simulation methods to ensure whether the suggested configuration will tolerate the expected load. Load tests may include estimation of data size in a database and/or transactions rate in a local or wide area network.

IV. Post-Selection Sub-Process

This section reviews activities that are suitable to be done after the selection sub-process.

A. The First Phase - Making Decision about the Implementer

The final question that might be raised is whether the implementer of the selected ERP package is the same ERP vendor or a third party company used for the implementation stage? If the implementer is different from the ERP vendor, it is necessary to repeat the evaluation and selection steps to select an implementer, definitely by applying some changes. For instance, the following items could be used in the evaluation list of implementers:

- Is the implementer equipped with a specific implementation method? To what extent this method is scientific and how much is practical and experimental? In what business type, size and distribution this method is usually used?
- What are the strategies of the implementer to implement ERP packages?
- What scheduling is offered by the implementer to fulfill the implementation project?
- How much is management capabilities and project control skills of the implementer?

B. The Second Phase - Preparing the Proposal to Management

The proposal to management, which is the final report, consists of the following items:

- Introduction of the selected ERP package with its advantages and disadvantages. This is produced based on gathered information in the evaluation step.
- Comparative table of ERP systems (see section 3.2)
- Estimation of costs of the ERP implementation
- Approximated planning (including scheduling) of the implementation project
- Clear proposal to get management approval

C. The Third Phase - Establishing Experience Gaining Sessions

Finally, it is recommended that meetings in the form of experience gaining sessions (or reviewing learned lessons) to be held that in which participants in the selection process, especially functional groups, accurately review the traversed selection path. The main goal of these meetings is to clarify which tasks of the selection process have been done well and which tasks could have been done better. Later, these experiences would be used to improve the process of evaluating other enterprise level software systems. Even, these practices are very useful to improve general level of organization's project management skills.

V. Conclusions and Future Work

In this paper, a systematic approach to select an ERP package has been offered that suggests performing activities prior and subsequent to the primary selection step. On the other hand, in the proposed approach some ideas are used that accelerates the selection process at the same time that reduces the probability of an erroneous final selection. As some research areas related to the work field of this paper, the following could be mentioned:

- Study (or develop) an appropriate tool to support the process steps and methods suggested in this paper.
- Customize the process suggested in this paper for organizations that have specific business type, organizational structure or even products (for manufacturing organizations) or organizations that benefit from high technologies to do their business processes.
- Provide a formal model to compromise between the selected software features (functional and non-functional) and its related costs, in cases that purchasing and implementing the suggested software cost a lot.

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